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PRODUCTIVITY SPILLOVERS AND REGIONAL DIFFERENCES: SOME EVIDENCE ON THE ITALIAN MANUFACTURING SECTOR

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Abstract

This work examines the main theoretical and empirical interpretations regarding the effects of foreign direct investment on productivity of local firms and, in particular, in which way productivity spillovers are related to the existence of regional differences.

By taking into consideration the Italian manufacturing sector and using cross-section data, we find that although at a national level productivity levels are higher in the domestic sectors where multinational firms account for larger shares, productivity spillovers are concentrated only in the north-western area of Italy.

Key words: foreign direct investment, productivity spillovers.

JEL classification F23; 030

1. Introduction[1]

The technological diffusion is a process by which innovations (i.e. new products, new processes or new management methods) spread within and across countries. In the economic theory, it is commonly agreed that the creation and the diffusion of new technology is one of the major determinants of economic growth, international competitiveness and trade performance. This view has been recently supported by the endogenous growth theory (Grossman and Helpman, 1991) which has emphasised the crucial role played in an international environment by both dynamic comparative advantages and international competition.

By exploiting comparative advantages embodied in host countries and/or overcoming market imperfections, foreign direct investment (FDI) and multinational enterprises (MNEs) have been traditionally considered as an important vehicle in the process of diffusion of technological and organisational innovations. In such one-way process, the multinational enterprises' (MNEs) home country has been essentially regarded as the centre from where

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innovations flow to the various host countries.

However, the change in the dynamics of the international competition has pushed MNEs to transform themselves into *learning organisations*, which are interested in finding access to technology and innovations in a variety of host countries. As a result, FDI has been increasingly used as a means to tap innovation capabilities which are present in the host countries (Levitt and March, 1988; Kogut and Chang, 1991), thus preserving opportunities for future organisational learning and fostering technological spillovers on local firms. In such a picture, a new element, which has been recently emphasised in the literature (Amin and Tomaney, 1995), is the sub-national or regional dimension of the systems of innovation. Cantwell and Iammarino (1998, p. 384) have pointed out that "the MNE networks for innovation conform to a geographical hierarchy in different regional centres; accordingly, the technological specialisation of foreign firms in different regional locations depends upon the position of the region in the hierarchy, i.e. whether the regional system is at the top of the hierarchy (higher order location) or is a lower order regional centre". This issue is very important not only to better understand the process of globalisation of technological activities but also to interpret more carefully the potential benefits of FDI for the host countries.

By taking into consideration the Italian manufacturing sector and using cross-sectional data, the purpose of this paper is twofold. First, we have tried to demonstrate whether and how technical knowledge has been transferred to domestic firms owing to the mere presence of MNEs; second, we have examined whether productivity spillovers are related to the existence of regional differences. This paper is organised as follows. In the next section, we give a short discussion on the nature of productivity spillovers; section 3 describes the data set and the statistical model used; in section 4 the empirical results are presented and, finally, in section 5 we draw the main conclusions.

2. *Productivity spillovers and multinational firms: some issues*

The term “spillover” refers to the indirect effects generated by the presence of foreign firms both in the industrial structure of the host country and in the conduct and performance of local firms. There are a number of spillover effects of FDI identified by the literature (Caves, 1974; Blomstrom, 1989; Blomstrom and Kokko, 1996). In particular, it is argued that the productivity of local firms may be mainly stimulated by three factors such as an increasing competition, the enhancing of human capital and the diffusion of new technologies. Since the degree of foreign penetration is likely to be higher in those sectors where the barriers to entry for new firms are high, the entry of foreign firms increases the degree of market competition and improves the allocative efficiency in the host country industrial structure. Also, another source of gain to the host economy could arise from the enhancing of human capital, which is due to the training of labour, and management that may later be employed by local firms. Moreover, foreign affiliates may speed up the cross-border transfer of technology and innovation causing them to disseminate faster than otherwise among domestic firms that competes with them. On the basis of such arguments, it has been postulated that: productivity levels are higher, ceteris paribus, in the domestic sectors where multinational firms account for larger shares. This proposition has been tested by some statistical analyses for different countries: Caves (1974) for Australia; Globerman (1979) for Canada; Blomstrom and Pearson (1983) and Kokko (1994) for Mexico; Haddad and Harrison, (1991,1993) for Morocco; Aitken and Harrison (1991) for Venezuela; Imbriani and Reganati (1997) for Italy, Kokko, Tansini and Zejan (1996) for Uruguay and Aslanoglu (1998) for Turkey.

Using cross-section data for three or four digit classification, Caves (1974), Globerman (1979) Blomstrom and Pearson (1983), and Imbriani and Reganati (1997) found that the foreign presence had a significant impact on the labour productivity of domestic firms and, therefore, spillovers were found significant. On the contrary, using panel data Haddad and Harrison (1993) concluded that although domestic firms exhibited higher levels of productivity in

sectors with a larger foreign presence, there was no significant relationship between larger foreign presence and higher productivity growth in domestic firms. Aslanoglu (1998) reached a similar result for the Turkish manufacturing sector. In particular, he found that while the presence of foreign firms increases competition in domestic industries, there was no significant contribution on the productivity of domestic firms.

An issue that has aroused some controversy in the theoretical literature concerned the relationship between spillovers and the size of the technology gap. In fact, we can distinguish at least two different positions. Some scholars (Koizumi and Kopecky, 1977; Findlay, 1978; Wang, 1988, Wang and Blomstrom, 1992) have pointed out that spillovers grow with the size of the technology gap between domestic and foreign firms since the country's technical efficiency is an increasing function of the country's capital stock owned by foreign residents which are supposed to possess superior technical knowledge.

The second position concerns the idea that according to the "technological accumulation" literature (Cantwell, 1989) spillovers are more important in the industries where the technology gap is small. If foreign affiliates invest in a host country which represents itself a centre for innovation in the industry concerned, they are likely to have a positive impact on the host country economy because they contribute to strengthen and diversify local research and to stimulate the innovation of local competitors. Over time, FDI might set in motion a virtuous circle of increasing research intensive activity and a faster output growth.

The link between spillovers and the size of the technology gap has been tested for the case of the Mexican economy by Kokko (1994), for the Uruguayan economy by Kokko, Tansini and Zejan (1996) and for the Italian manufacturing sector by Imbriani and Reganati (1997).

Kokko (1994) pointed out the “enclave” characteristics of sectors in determining productivity spillovers. “Enclave” characteristics refer to industries where large technology gap and high foreign shares coincide. He found that in industries with enclave characteristics foreign firms take over and force local firms into narrow niches where the products and technologies of MNEs are not profitable. Accordingly, there is little scope for positive spillovers on

domestic industries. Imbriani and Reganati (1997) found that productivity levels are higher the lower the sizes of the technology gap between domestic and foreign firms. As a result, they concluded that if MNEs have chosen the Italian location because it represents itself a centre for innovation in the industry at a global level and, therefore, the presence of foreign firms is justified by the possibility to find an environment capable of increasing their technological advantage. Finally, Kokko, Tansini and Zejan (1996) found that a positive and statistically significant spillover effect only in plants with a moderate technology gap vis-à-vis foreign firms.

However, it is worth noting that all these studies have examined the effects of FDI on domestic firms by interpreting the manufacturing sector at a national level. In other terms, no tests have been performed on the existence of regional differences in productivity spillovers. In the Italian case, this seems to be a central point if we consider the particular productive structure of the country which shows a strong dualism between the North and the South areas as well as strong differences even within the two areas. Cantwell and Iammarino (1998) have found that the location of technological activities of foreign firms tends to be strongly agglomerated at a sub-national level. Lombardia and Piemonte can be considered higher order locations at the top of the scale, strongly attracting a broad range of foreign-owned technological activities due to their regional systems of innovation. Therefore, in this work we intend to use some unit of analysis that allows for investigation below the traditional country level.

3. Data, definitions of variables and statistical model

The empirical analyses are based on industrial data supplied by the Italian Central Institute of Statistics (I.S.T.A.T.) which we gratefully acknowledge. In particular, firstly we have selected a sample of 942 foreign firms, which undertake international production in the Italian manufacturing sector. In this work, we define domestically owned firms, as firms where the share of domestic own-

ership is above 50 per cent. Then we have collected information on the following variables: total number of employees, value added, gross output, investments, number of both manual and non-manual workers and concentration ratios. As a result, we obtained for the year 1992 a set of information covering 93 industries at a three-digit level of the manufacturing sector. However, when our analysis moved to the territorial distribution of foreign firms, we had to increase the degree of industrial aggregation, because the ISTAT by law cannot provide information on sectors where less than three firms operate. Therefore, in this paper we are able to analyse data for 35 industries.

Following other empirical studies conducted at a sector level (Caves, 1974; Globerman, 1979; Blomstrom and Pearson, 1983; Kokko, 1994; Aslanoglu, 1998), we have analysed the presence of spillovers through a statistical model based on linear estimations of the labour productivity of domestic firms as a function of the degree of foreign penetration. If we find a positive significant relation between the domestic labour productivity and the foreign affiliates' market share, it follows that the foreign investment does raise the productivity in domestically-owned firms through spillovers.

However, to test extensively the spillover hypothesis, it is necessary to take into consideration other factors that can explain labour productivity, i.e. capital intensity, labour quality and concentration levels. Therefore, we hypothesise that the labour productivity of domestic firms can be estimated by the following function:

$$Val_d = a_1 + a_2 FP + a_3 KL_d + a_4 LQ_d + a_5 CONC + e$$

In this equation the dependent variable (VAL_d) represents the labour productivity of domestic firms. This variable has been calculated by dividing the value added to the total number of employees in domestically owned firms. The degree of foreign penetration in each industry (FP) has been measured by the ratio of the foreign firms' employment to total employment. If spillover takes place, it is expected to have a significant positive effect on local labour productivity.

Data on capital stock are, unfortunately, not available. KL_d represents total investment per employee and is constructed to con-

trol for capital intensities. Labour quality (LQ) has been measured by the ratio of non-manual workers to manual workers in domestically-owned firms in each industry. A positive relation between labour productivity and capital intensity as well as labour quality is expected in the econometric estimation.

Finally, the level of market concentration (CONC) is measured by the five-firm concentration ratio. From the point of view of theoretical considerations there are different opinions as to whether high concentration (low competition) increases or decreases productivity. Strong competition may, on the one hand, force firms to improve upon production processes, etc. but, on the other hand, may slow down the speed of innovation. The sign of the coefficient for CONC will help us to judge whether competition increases or decreases productivity.

4. Statistical results

The statistical method of estimation is the ordinary least squares. We start by examining if there are positive spillovers from FDI in the total Italian manufacturing sector. In Table 1, the first equation represents the result of OLS estimation for the total sample of 35 industries.

Statistics and diagnostic test results of the model suggest that there is no serious problem in the specification of the model. Test results allows us to conclude that there is no problem of serial correlation, misspefication of functional form, normality and heteroscedasticity. The values of R-squared and R-Bar-squared indicate that the sample regression line fits well the data.

Looking at the table 1, we can see that all variables, except LQ, have statistically significant coefficients with the expected signs and provide some support for our prior hypotheses regarding the direction of effects. In particular, the foreign penetration variable (FP) registers a positive coefficient that is significantly different from zero at the 5 per cent level and, therefore, the presence of spillovers is confirmed. The coefficient for the capital-intensity

variable (KL_d) has also the expected sign and is significantly different from zero at the 1 per cent level. Also, we see that the CONC variable has a negative and significant coefficient.

Table 1: Productivity spillovers at national level in the Italian manufacturing sector, 1992

Equation	*Constant*	*FP*	*LQ*	*KL*	*CONC*	*R-Bar-Squared*	*F-stat*	*DW-stat*	*N*
1. Total	0.636	0.0865	0.0448	0.332	-.1005	.8187	38.27	1.62	34
	12.63[a]	2.53[b]	1.41	11.69[a]	-2.87[a]				
2. High gap	0.590	0.0593	0.2545	0.1530	-0.0810	.5288	4.93	1.64	16
	6.23[a]	1.15	2.146[c]	1.07	-1.29				
3. Low gap	0.591	0.1226	0.0707	0.314	-.0444	.9376	64.94	2.04	18
	9.75[a]	2.34[b]	1.62	13.45[a]	-1.20				

Note: levels of significance are denoted by a (= 1 per cent), b (= 5 per cent), and c (= 10 per cent).

We continue our analysis by examining if spillovers are affected by the size of the productivity gap. Following Kokko (1994) the productivity gap has been measured by the ratio of value added per employee in foreign firms to the value added per employee in domestically owned firms. The median value on this measure has been then used to divide the entire manufacturing sector into two sub-samples: "low technology gap" industries and "high technology gap" industries. The former group is made up by those industries whose measure for the technology gap is below the average value, while the latter comprises those industries whose measure for the technology gap is above the average value. Looking at equations 2 and 3 in table 1, we can see that a small technology gap spurs spillovers from FDI. As a matter of fact, the FP coefficient is statistically different from zero at the 1 per cent level only for the industries where the size of the productivity gap is small. This result is similar to the one obtained by Imbriani and Reganati (1997) in a previous work with a lower degree of industrial aggregation. For the two sub-groups, using the Chow test we found that the pooled regression should not be run.

In table 2 we report the estimates for productivity spillovers in

the Italian manufacturing sector at sub-national level[2]. In particular, equation 1 is referred to the north-western region, equation 2 concerns the north-eastern area and equation 3 regards the centre-southern area. Looking at the table, we may note that productivity spillovers are present only in the north-western area. The FP variable carries a positive coefficient both for the north-western and the centre-southern areas and a negative sign for the north-eastern region However, the coefficient is statistically significant at the 5 per cent level only in equation 1. The capital intensity coefficient is always of the expected sign and statistically significant at the 1 per cent level. The labour quality variable carries the expected positive sign and it is significant at the 1 per cent level both in the north-eastern and in the centre-southern regions. The coefficient for CONC is negative and significant for both the Northwest and the Centre-south, but positive and significant for the North-east.

Table 2: Productivity spillovers at regional level in the Italian manufacturing sector, 1992

Equation	*Constant*	*FP*	*LQ*	*KL*	*CONC*	*R-Bar-Squared*	*F-stat*	*DW-stat*	*N*
1. N-W	0.6785	0.1020	0.0234	0.3394	-0.1518	.8426	43.83	2.52	33
	10.62[a]	3.01[a]	0.71	12.62[a]	-2.90[a]				
2. N-E	0.6232	-0.0567	0.1739	0.2254	0.1409	.5936	10.13	2.15	26
	7.41[a]	-1.20	3.22[a]	2.81[a]	1.81[c]				
3. C-S	0.6094	0.4404	0.1298	0.2553	-0.1117	.5920	12.24	2.47	32
	9.47[a]	1.24	4.19[a]	5.42[a]	-2.22[b]				

Note: levels of significance are denoted by a (= 1 per cent), b (= 5 per cent), and c (= 10 per cent).

Finally, we continue our analysis in table 3 by examining the relationship between the technology gap and productivity spillovers

2 The north-western region comprehends Lombardia, Piemonte, Liguria and Val d'Aosta; the north-eastern region is composed by Friuli, Trentino, Veneto and Emilia; and finally the centre-southern area comprehends Toscana, Marche Lazio, Umbria, Abruzzo, Molise, Campania, Calabria, Basilicata, Puglia, Sicilia and Sardegna.

in the north-western area. In this case, we found that spillovers are higher, the lower is the size of the technology gap between domestic and foreign firms. Even in this case the Chow test gave us a strong support in considering the separate regressions instead of the pooled one.

Table 3: Productivity spillovers and technology gap in the north-western area, 1992

Equation	*Constant*	*FP*	*LQ*	*KL*	*CONC*	*R-Bar-Squared*	*F-stat*	*DW-stat*	*N*
1. Low gap	0.6942	0.1458	0.0360	0.2154	-0.1024	.5678	6.583	1.77	18
	8.58[a]	2.95[b]	-1.08	2.28[b]	-2.11[c]				
2. High gap	0.5591	0.0890	0.1524	0.2922	-0.0027	.9305	47.88	2.04	15
	6.80[a]	1.07	2.09[c]	6.64[a]	-.026				

Note: levels of significance are denoted by a (= 1 per cent), b (= 5 per cent), and c (= 10 per cent).

To sum up our results from the estimations, we can stress that the effects of FDI are strictly concerned with the structure of the Italian productive system. In general terms, it is well known that in Italy there is an economic and social dualism between the North and the South; but it is also true that, even within the northern area, there is a dichotomy in terms of productive and innovative systems.

In particular, in the north-western area it is confirmed that the Italian firms are able to catch through FDI the benefits arising from the spillovers because the foreign presence strengthen the already existing domestic technological capability. In this regard, Cantwell and Iammarino (1998) found that more than 77% of the total research activity of large firms is concentrated in Lombardia and Piemonte; in particular for foreign-owned firms the aggregate share of the two regions is 68.4 %, while for local firms it is almost 82 per cent.

Also, if on the one hand our analysis refused the presence of spillovers for both the north-eastern and the centre-southern areas, on the other hand it is worth noting to attempt a reasonable interpretation on the reasons why this happens. In fact, the two re-

sults need a deep differentiation in terms of explanation which has to take into account the substantial socio-economic differences of the North-East and centre-South.

The north-eastern region is characterised by a very good performance in terms of growth which has been interpreted in the context of "the industrial district model" (Becattini,1987, 1990; Brusco 1986). Here, efficiency is mainly endogenous and it is generally referred to small and medium sized firms that have a self-propelling capacity to get efficiency and to be competitive at an international level. In this respect, it may be plausible to justify the *non-spillovers result* saying that the learning possibility of local firms is quite weak due to the differences in plant-size with the foreign affiliates and, more generally, to the different model of organisation and production.

On the contrary, the interpretation of the *non-spillovers result* for the centre-southern area is concerned with the different basic conditions mainly in social terms, which makes the localisation of investment unattractive both for domestic and foreign capital. It is also likely to think that in this area foreign affiliates, when they are present, have crowded out the domestic firms so that there is nobody able to absorb the potential spillovers.

Finally, it is worth noting that in both areas the specialisation of foreign affiliates in industries with product differentiation shows that there is not much scope for spillovers because both foreign and domestic firms operate in different segments of the market and the varieties which they produce are not directly comparable.

5. Concluding remarks

This paper has examined productivity spillovers in the Italian manufacturing sector in 1992 and has attempted to determine whether regional differences affect the distribution of the observed spillovers. The results obtained emphasise some particular characteristics of the reasons why some industries in the north-western area of Italy are able to attract FDI; in fact, in a world where the

globalisation of the economic systems will be played by the enterprises according to their capacity to innovate and to optimise their organisational and productive capabilities, the decisions of MNEs in terms of location strategies will increasingly take into account the "environment" (technological capability, human capital, etc.) in which they will operate. In other words, this means that domestic firms have to be comparable in many aspects with foreign firms and that it is highly probable that FDI will produce relevant spillovers for the host countries.

Finally, it is obvious that we are doing this analysis not only because we want to emphasise the different effects of FDI on the Italian macro-regions, but essentially because this is a very useful starting point to individuate the right policies which are to be implemented. Obviously, if the Italian government wants to encourage FDI in order to benefit from productivity spillovers, it should concentrate on industries where local technological capability is already strong through policies which reinforce the competitive pressure in the market and increase the degree of technological accumulation.

But considering the socio-economic problems deriving from the strong national dualism, it is worth noting to stress that the effort to think an innovative policy has to regard essentially the Centre-South. As far as this area is concerned, it is necessary to start with a policy which reduces the cost of technology transfer, i.e. to find out policy instruments aimed to enhance both the learning capability and the human capital of the local firms as a preliminary step necessary to create the correct environment for the FDI.

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